MONO COUNTY GENERAL PLAN DRAFT EIR

SECTION 4.5

GEOLOGY, SOILS AND MINERAL RESOURCES

4.5.1 INTRODUCTION AND SUMMARY

This section describes the existing soil and geologic characteristics of Mono County, and the potential impacts on these resources that may occur in association with the proposed comprehensive update to the County's General Plan & RTP. Information for this section is based in large part on data from the Mono County Master Environmental Assessment, as well as other sources as cited in the text. The MEA can be accessed at http://www.monocounty.ca.gov/. Key findings are summarized in the table below.

SUMMARY OF GENERAL PLAN IMPACTS & POLICY MITIGATIONS FOR GEOLOGY, SOILS & MINERAL RESOURCES

IMPACT LU 4.5(a):	**Exposure to Seismic Effects**
Pre-Mitigation Significance:	**Potentially Significant Impacts**
Mitigating Policies:	**See Table 4.5-5 in Appendix D**
Residual Significance:	**Potentially Significant Impacts**
IMPACT LU 4.5(b):	**Erosion Impacts**
Pre-Mitigation Significance:	**Potentially Significant Impacts**
Mitigating Policies:	**See Table 4.5-5 in Appendix D**
Residual Significance:	**Potentially Significant Impacts**
IMPACT LU 4.5(c):	**Exposure to Unstable Geologic Conditions**
Pre-Mitigation Significance:	**Potentially Significant Impacts**
Mitigating Policies:	**See Table 4.5-5 in Appendix D**
Residual Significance:	**Potentially Significant Impacts**
IMPACT LU 4.5(d):	**Expansive Soils Unsuited to Septic Systems**
Pre-Mitigation Significance:	**Less than Significant**
Mitigating Policies:	**See Table 4.5-5 in Appendix D**
Residual Significance:	**Less than Significant**
IMPACT LU 4.5(e):	**Loss of Mineral Resources**
Pre-Mitigation Significance:	**Potentially Significant Impacts**
Mitigating Policies:	**See Table 4.5-5 in Appendix D**
Residual Significance:	**Potentially Significant Impacts**

4.5.2 KEY TERMS USED IN THIS SECTION

Basalt, Volcanic rock or lava that is characteristically dark in color, rich in iron and magnesium, and contains 45% to 54% silica.

Bishop Tuff, A welded tuff (sometimes known as the world's 'roughest and toughest volcanic landform') that was created 760,000 years ago during the massive Long Valley Caldera eruption. The welded tuff comprises pyroclastic flows and ash fall that had enough heat to weld together when deposited; the strength of the

welding generally decreases with distance from the source. The Bishop tuff material found in the volcanic tableland south of the Long Valley Caldera is the largest exposure in the world.[1]

Dacite. An igneous volcanic rock that is generally associated with older volcanoes and consisting mainly of plagioclase feldspar with a porphyritic structure (i.e., scattered larger crystals in a fine-grained groundmass). Dacite usually forms as an intrusive rock (such as a dike or sill). Dacitic magma is notably viscous and thus prone to explosive eruption such as occurred on Mount St. Helens in Oregon, where dacite domes formed from previous eruptions.

Fumarole. An opening in the earth's crust that emits steam and gasses including carbon dioxide, sulfur dioxide, hydrogen chloride, and hydrogen sulfide. Steam is created when superheated water turns to vapor as it emerges.

Ground Failure. The term ground failure is a general reference to landslides, liquefaction, lateral spreads, and any other consequence of shaking that affects the stability of the ground.

Lateral Spread. Lateral spread or flow are landslides that commonly form on gentle slopes and that have rapid fluid-like flow movement, like water.

Liquefaction. Defined by USGS as a process in which water-saturated sediment temporarily loses strength and acts as a fluid (similar to when toes are wiggled in wet beach sand). This effect can be caused by earthquake shaking.

Mercalli Scale. A seismic scale used for measuring the intensity of an earthquake. It measures the effects of an earthquake, and is distinct from the moment magnitude (a measure of the energy released). The scale ranges from I (imperceptible shaking) to X or higher (in which most masonry and frame structures – and some well-built wooden structures – are destroyed). The **lower** numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage.

Phreatic Eruption. Steam-driven explosions that occur when groundwater or surface water is vaporized by magma, lava, hot rocks, or pyroclastic-flow deposits.

Pyroclastic Flow. A fast-moving (up to 450 mph) current of hot (temperatures of about 1,830˚F) gas and rock -- collectively known as tephra, that hugs the ground and travels downhill or spreads laterally under gravity. Flow speed depends on the density of the current, the volcanic output rate, and the slope gradient.

Rhyolite. Volcanic rock or lava that is characteristically light in color, rich in potassium and sodium, and contains 69% silica or more.

Shear Zone. A zone that is composed of rocks that are more highly strained than the rocks adjacent to the zone. Shear zones often occur at the edges of tectonic blocks, forming discontinuities that mark distinct terranes.

4.5.3 BASELINE CONDITIONS[2]

4.5.3.1 **Regional Geologic Setting:** Mono County lies at the boundary of two major physiographic provinces – the Sierra Nevada mountains (part of the Pacific Province, one of the most geologically young and seismically active mountain ranges in North America and covering roughly 400 miles in length and 70 miles in width), and the Basin and Range province (which includes much of western North American and is comprised of closed drainage basins, ephemeral lakes, plateaus and valleys alternating with mountains). The Sierra Nevada are formed of a great block of granitic rocks that are overlain by sedimentary and metamorphic materials that have been uplifted on the eastern side and tilted westward. The Pacific Province is at the boundary of several tectonic plates that move on the crust and uppermost mantle of the earth.

[1] Charity Southworth, *The Bishop Tuff : An Overview of the World's Roughest and Toughest Volcanic Landform* (Indiana University, 2012). Online: http://www.indiana.edu/~sierra/papers/2012/Southworth.pdf

[2] Portions of this review of baseline geologic and soil conditions in Mono County are condensed from a more detailed discussion provided in the Mono County Master Environmental Assessment; also referenced in this section is USGS, *U.S. Geology in the Parks* USGS website: (http://geomaps.wr.usgs.gov/parks/province/pacifmt.html).

4.5.3.2 **Uplift, Erosion, Glaciation:** The granitic rock base of the Sierra Nevada formed during the Mesozoic Era, when an arc-shaped chain of volcanoes erupted. Some of the material rose to the surface as lava, but most of the materials solidified below the surface, forming the granitic base. Over time, the Sierra Nevada has been shaped by numerous volcanic eruptions, and also by ongoing erosion. During the Miocene Epoch (less than 20 million years ago), the continental crust east of the Sierra Nevada began to stretch in an east-west direction that led to the formation of a series of north-south-trending valleys and mountain ranges—the beginning of the Basin and Range province. The eastern margin of the range began to rise about 5 million years ago. This uplift, combined with down-dropping of the area to the east, allowed the Sierra Nevada to rise far more steeply to the east than to the west – creating the tilted fault block that is today characterized by a steep eastern slope and a long gentle slope westward to the Central Valley as depicted in Figure 4.5-1 below.[3] The period of uplift was followed by the Pleistocene (Ice Age) Epoch, during which glaciers formed and moved downslope, creating U-shaped valleys and leaving morainal deposits.

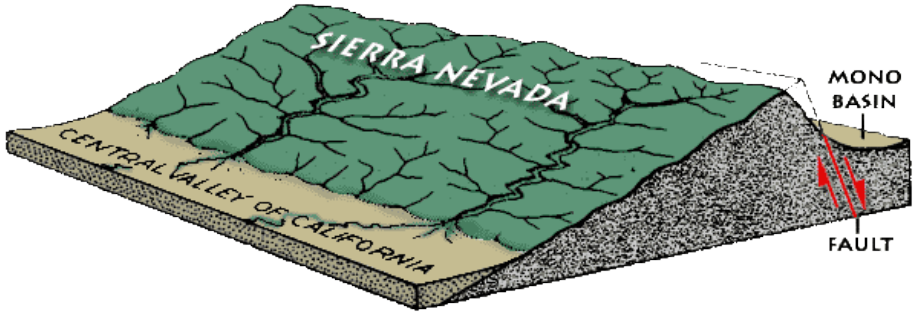

FIGURE 4.5-1: Uplift of the Sierra Nevada

4.5.3.3 **Volcanic History:** Abundant volcanic materials overlie the granitic block-faulted structure of the Sierra Nevada. Basaltic rocks dating to 3 million years ago can be found at a number of locations throughout Mono County that are apparently unrelated to more recent volcanic activity in the Long Valley Caldera. Volcanic materials associated with the Long Valley Caldera first appeared about 1 million years ago at Glass Mountain, where eruptions eventually lead to a cataclysmic eruption of Bishop Tuff volcanic materials over a large region of the western United States. The eruption was followed by collapse of the magma chamber, which formed the Long Valley Caldera (among the largest on earth). Within roughly 100,000 years of that eruption, the central area of the caldera floor began rising, pushed upward by the intrusion of molten rock into the magma reservoir that lies below the caldera.

Over the past 2,000 years, volcanic eruptions have occurred at an average rate of one per 100 years. Movement in the caldera has caused numerous earthquakes. Since 1974, USGS has conducted ongoing monitoring of the caldera for volcano surveillance (earthquakes often serve as an early sign of volcanic unrest). Earthquake swarms occurred at Long Valley from 1978-1983, 1990-1995, 1996, and 1997-1998. USGS indicates that the rate of earthquakes in recent years has been relatively low compared with the history since seismic monitoring started.

The Mono County MEA notes that USGS has prepared a comprehensive response plan for volcanic hazards related to the Long Valley Caldera and the Mono Craters, based on their finding that the area is capable of further volcanic activity. The plan is based on a 5-level ranking system that indicates the probable strength and timing of an impending eruption.

[3] Exhibit source is USGS, *U.S. Geology in the Parks,* op cit.

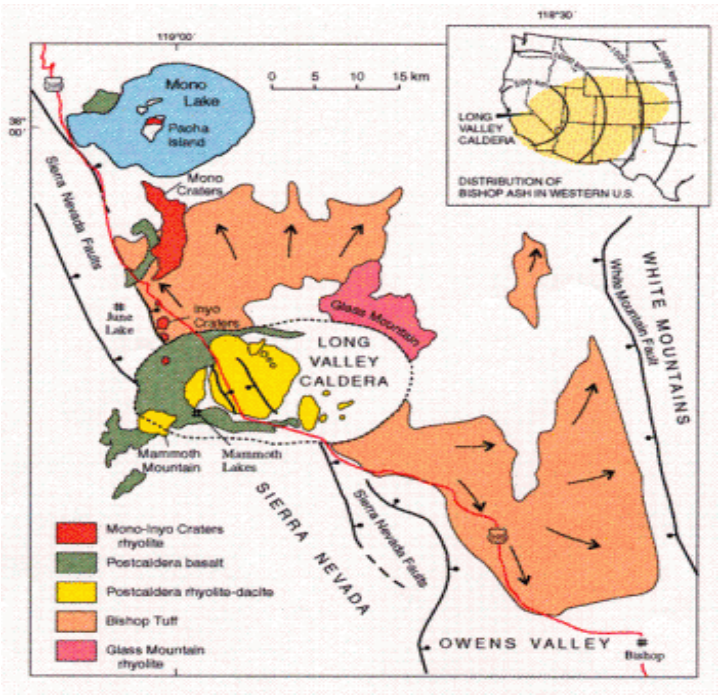

FIGURE 4.5-2: Long Valley Caldera

In the event of an eruption, USGS anticipates that it would produce small to moderate amounts of silica lava similar to eruptions that occurred in very recent times (550-650 years ago) including:

- Phreatic (i.e. steam-driven) eruptions; as in some recent events, the eruption may be limited to a phreatic event with steam blasts and rocks thrown up to several hundred meters from the vent;
- An explosive magmatic phase in which hot pumice and ash would be ejected thousands of feet into the air, producing thick pumice accumulations near the vent, fine ash deposits downwind, and pyroclastic flows; and
- A final phase involving the slow extrusion of lava to form steep sided flows and domes.

Such eruptions could occur over a period of days or even weeks. USGS indicates that an event of the magnitude that occurred 700,000 years ago is conceivable but unlikely.

4.5.3.4 Unique Geologic Features: The tectonic, volcanic and glacial history of Mono County has created an astonishing range of unique geologic features, many of which are recognized and protected under various state and federal programs. Notable features include Black Point (an eroded volcanic cone of basaltic debris that formed under Mono Lake roughly 13,300 years ago); Panum Crater (a classic rhyolitic lava dome that is part of the Mono-Inyo Craters and located just south of Mono Lake); the Mono-Inyo Craters (a volcanic chain of craters, domes and lava flows including the generally phreatic Mono Craters to the north and the generally phreatic and rhyolitic Inyo Craters to the south, as well as the fumaroles and explosion pits on Mammoth Mountain and a set of cinder cones south of Mammoth Mountain known as the Red Cones); Obsidian Dome/Glass Creek/Deadman Creek (three vents located along a north-south alignment near June Lake that all erupted in 1350; Obsidian Dome erupted outside the caldera, but Glass Creek – which erupted just north of the caldera wall and flowed into the caldera -- and Deadman Creek Dome – which erupted inside the caldera a dome – both contain some of the residual Long Valley Caldera magma); Negit Island and Paoha Island (volcanic cones located in Mono Lake; Negit Island is composed of three dark dacite lava flows and serves as an important nesting ground for migratory birds whereas Paoha Island is composed of lakebed sediments, deposited above volcanic domes, with abundant hot springs and fumaroles on the surface); ash deposits of Bishop Tuff in the volcanic tableland (the volcanic landscape, located six miles north of Bishop, that was formed during the Long Valley caldera eruption), ash deposits exposed in stream cuts along Wilson and Lee Vining creeks and at Deadman Summit on US 395; glacial erosion and moraines (particularly around Twin Lakes, June Lake, Convict Lake and McGee Canyon), and spring

deposits and activity at numerous hot springs northwest of Lake Crowley (including Travertine Hot Springs, Casa Diablo, Hot Bubbling Pool, Hot Creek Gorge and others).

4.5.3.5 Mineral Resources: Gold and silver mining once attracted early settlers to Mono County, but mining now has only a small role in the Mono County economy, primarily related to pumice (the most valuable mineral commodity), clays, chalk, sand and gravel, with occasional exploration for precious metals in the Bodie Hills. Please refer to EIR §4.5.3.8 for a more detailed discussion of Mineral Resources in Mono County and potential impacts resulting from the Draft *RTP/General Plan Update*.

4.5.3.6 Seismicity and Volcanic Hazards: The Multi-Jurisdictional Local Hazards Mitigation Plan notes that Mono County is in an area of California with a major fault system known as the Eastern California Shear Zone (ECSZ), one of two systems (along with the San Andreas Fault system) that account for most of the movement between the Pacific and the North American plates; about 10mm/year (~0.4"/year) of slip occurs on faults east of the Sierra Nevada (see Figure 4.5-3 below). The MEA (XII-Geology) notes that Mono County is located at a stress point, where the earth's crustal plates exert opposite pressures against each other. This combination creates both "tectonic" earthquakes (land mass movement) and volcanic activity that can trigger earth shaking. The primary seismic hazard in the County is strong to severe groundshaking; the County is in Seismic Zone 4, which has an associated ground acceleration of 0.40 'g' and requires stringent engineering and construction for new and existing structures (per CGC §8875, existing buildings that may be subject to seismic hazards must now comply with requirements of the unreinforced masonry building law).

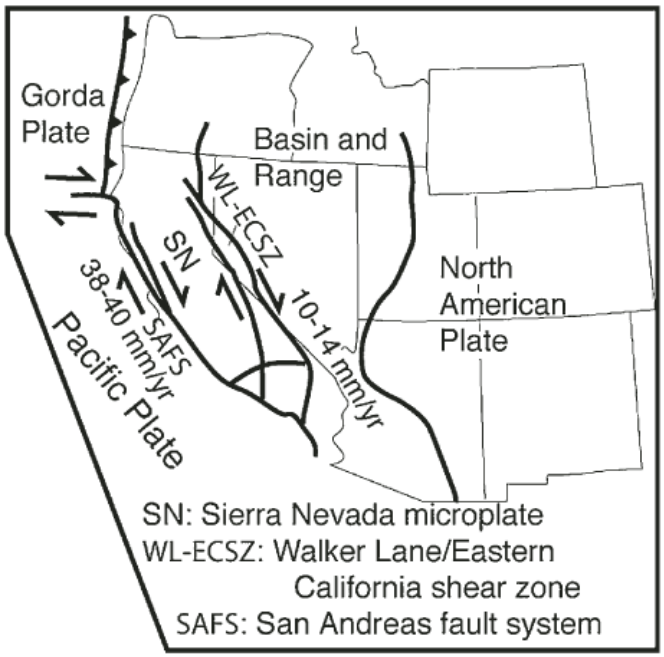

FIGURE 4.5-3: Eastern California Shear Zone[4]

The Multi-Hazard plan states that the oval shaped Long Valley Caldera (see Figure 4.5-2) spans an area roughly 10 by 20 miles, and is among the largest volcanoes in the continental United States. It was formed roughly 760,000 years ago following the massive eruption of the Bishop Tuff. Recent geological unrest has resulted in uplift of the resurgent dome in the central section of the caldera and earthquake activity followed by periods of relative quiescence. Uplift of the resurgent dome since 1989 now amounts to over 30 inches. Since early 1998, the caldera has been in a state of low activity. The cause of unrest is still debated.

[4] Fieldguides.gsapubs.org, *A Transect Spanning 500 Million Years of Active Plate Margin showing the Pacific plate, the San Andreas fault system, the Sierra Nevada microplate, and the Walker Lane–Eastern California Shear Zone*

Earthquakes occur weekly, and almost daily, in the Eastern Sierra, in Mono County, and particularly in the Long Valley area. Most of the earthquakes are under magnitude 3 – too weak to be felt by people. Significant earthquakes (i.e., quake of magnitude 6.5 or greater that cause more than $200,000 in damage) occurred in Mammoth Lakes during 1980, and a magnitude 6.4 earthquake occurred in Chalfant Valley in 1986. Associated seismic and geologic hazards such as landslides, rockfalls, and ground failure have occurred in conjunction with earthquakes.

After a persistent swarm of earthquakes in 1989, geologists discovered that large volumes of carbon dioxide were present at various locations on Mammoth Mountain, most likely derived from magma in the caldera. Although normal levels of CO_2 are considered harmless, high concentrations can be potentially dangerous by displacing oxygen in confined spaces (such as cabins and tents), causing reactions that can include dizziness, disorientation, suffocation, and even death. The Multi-Hazard Plan indicates that areas with the lowest shaking hazard in the county include the eastern portion of the Bodie Hills and much of the area between Bridgeport Valley and the Antelope Valley. Most of the remainder of the county is subject to moderate earthquake shaking hazards. Areas along the ECSZ (in the southern half of the county) are shown as high hazard for damage from earthquakes of MMI VII or greater. During the 1980 Mammoth Lakes earthquake sequence, ground failure was prevalent at Little Antelope Valley, along margins of the Owens River in upper Long Valley, along the northwest margins of Lake Crowley, and along Hot Creek Meadow. Subsidence has also occurred throughout the county after seismic events.

Overall, seismic hazards are considered to be one of the most prevalent natural hazards in Mono County due to their repeated occurrence, the damage they have caused in the past, and the geographically widespread nature of the hazard. With use of the County and Town GIS system, parcels located in Alquist-Priolo Fault Hazard Zones have been identified as including 55 developed parcels (mostly residential), and more than 10 critical facilities including (a) the Topaz Interagency Fire Control Station; (b) Walker Senior Center; (c) California Interstate Telephone Co in Lee Vining; (d) Lee Vining Elementary School; (e) two Southern California Edison facilities in June Lake; (f) Canyon Lodge in Mammoth Lakes; (g) South California Edison facilities at the junction of US 395 and SR 203; (h) Geothermal Plants at junction of US 395 and SR 203; and (i) Mammoth Overpass at junction of US 395 and SR 203. Many more parcels are located in strong shaking areas, including 961 developed parcels (mostly residential), and a number of critical facilities. Preliminary surveys indicate that about 236 of these exposed units are in not structurally sound, primarily in June Lake, Antelope Valley, and the Tri-Valley. In general, however, Mono County's housing stock is in fair to good condition.

4.5.3.7 Geology and Watershed, Soils, Drainage and Erosion Potential: The Integrated Regional Water Management Plan (IRWMP) notes that the geology of each watershed influences hydrologic characteristics. Geologic structures serve as parent materials for soils, which in turn control infiltration rates, groundwater storage and transport, the chemistry of water bodies, erosion potential, formation and control of stream channels, and substrate for vegetation that uses water stored in the soil. Research conducted following the magnitude 6 earthquake of May 1980 in Long Valley facilitated a better understanding of groundwater storage, movement, chemistry, and interactions with surface flows. The IRMWP notes that volcanic activity also creates a geothermal energy resource that warms and adds minerals to groundwater, causing problems for municipal and domestic water production.

The IRWMP states that throughout the eastern Sierra Nevada, soils at lower elevations include sandy loams and decomposed granite (generally derived from granitic and volcanic parent materials). Soils on the valley flats are the most productive in the region, allowing successful agriculture in the Antelope Valley, Bridgeport Valley, and Owens Valley. The greatest potential for soil erosion occurs with sandy soils on steep slopes (where water flows over the surface and picks up soil particles), areas where vegetation has been removed and soils compacted, and where soils are exposed to high winds.

Steep slopes are generally found in the mountainous areas. The steepest slopes tend to be near the Sierra crest, which forms the western edge of the planning area. Most of the crest is above 10,000' in elevation, with substantial terrain above 12,000' (and a few summits above 14,000'). The crest is lowest (8,000-9,000') in the northwestern part of the West Walker River watershed; the highest elevations are found west of Lone Pine and Big Pine. Slopes trend toward lower gradients with distance from the Sierra Nevada crest. The valleys tend to be comparatively level, composed mostly of materials eroded from adjoining slopes.

The main watersheds in Mono County have been formed through the uplift and westward tilting of the Sierra Nevada (relative to valleys lying to the east) and by the massive eruption of the Long Valley Caldera. Subsequent volcanic activity, earthquakes, erosion, glacial deposition and stream channel processes have contributed to the present-day landscape. Glacial till from repeated glacial advances covers much of the elevation zone between 6,500 and 8,000' near the main creeks, while varied rock types occupy the surface and the subsurface zones of the watersheds. These various rock types have been further rearranged by numerous faults in the area. Extensive study shows that the substrate below Mammoth Lakes is particularly complex, with interleaved layers of volcanic materials, glacial till, and stream deposits that have been further folded by faulting. Volcanic processes have formed many of the Sierra uplands (including the Bodie Hills, Cowtrack and Glass Mountains, and the Volcanic Tablelands), while sediments from glacial and channel erosion, mass movements and surface processes have filled the valleys to depths as high as 7,500' in some areas of Owens Valley.

4.5.3.8 Geology and Minerals: The *Draft Conservation Element* indicates that significant mineral resources are present in Mono County. In accordance with the Surface Mining and Reclamation Act of 1975 (SMARA), local governments must plan for the conservation and development of identified significant mineral resource deposits and provide for the reclamation of mined lands. The intent of SMARA is to balance resource production with other values, and although local jurisdictions are required to address the conservation and development of mineral resources SMARA does not dictate land use policy.

Under SMARA, mineral resources are designed according to four categories: (1) MRZ-1 identifies areas where available information indicates little likelihood for the presence of resources; (2) MRZ-2a denotes areas that contain significant measured or indicated mineral resources; (3) MRZ-2b denotes areas where geologic information indicated that significant inferred or demonstrated sub-economic resources are present; (4) MRZ-3a indicates areas likely to contain mineral deposits similar to known deposits in the same area; (5) MRZ-3v indicates areas judged to be favorable for mineral resource occurrence but where such discoveries have not been made; and (g) MRZ-4 indicates areas where geologic information neither confirms nor disproves the presence of resources.[5]

According to a 1949 report prepared by the California Division of Mines,[6] mineral production since 1880 includes both metals and nonmetals; gold and silver represented more than 75% of recorded production over that time, primarily in the Bodie and Masonic districts, but also in areas west of Mono Lake, in Mammoth Lakes, and in the southern part of the Benton Range. Deposits of complex lead, copper and silver have been mined in the Blind Spring Hill area, while the east slope of the Sweetwater Mountains (near the state line) have deposits of argentite, cerargyrite (a silver ore), pyrite and gold. Lead and zinc occur in the limestone layers of Gull, June and Virginia Lakes as well as the West Walker River near Topaz (along with copper, gold and silver). Molybdenum is found south of Coleville and as an associated mineral in the tungsten ores of the South Benton Range where the principle tungsten deposits are found (these deposits are also present near McGee Creek, near Coleville, in the Saddlebag Lake area and the Bloody Mountain area). Dry Creek Canyon (on the west slope of the White Mountains) has been characterized as having the largest deposit of andalusite in the world, a result of contact-metamorphic action between the granitic rocks and alumina-rich sediments. Pyrophyllite (used in insecticides) is also found in that area.

Extensive beds of pumice in the volcanic series have been mined in large quantities for use as aggregate in concrete, insulating and acoustical plasters, cleaning products and abrasives. Perlite, a variety of rhyolite, is found south of Mono Lake, and vermiculite (also used for light aggregate) has been reported south of Coleville. Other mineral resources in the county include quicksilver, barite, clay, travertine, tuff (used as a building stone), sand and gravel, bottled waters, and medicinal salts (obtained from springs in Mono Lake).

[5] California Department of Conservation, Division of Mines and Geology, *Mineral Land Classification of the Eureka-Saline Valley Area, Inyo and Mono Counties, Calif.*. 1993. Special Report 166. Accessed at https://archive.org/stream/minerallandclass166tayl/minerallandclass166tayl_djvu.txt

[6] California Department of Natural Resources, Division of Mines, *Mineral Resources and Mineral Production during 1947,* Bulletin 142, 1949. (from http://archive.org/stream/countiesofca1947oocalirich/countiesofca1947oocalirich_djvu.txt).

A 2012 report of the State Mining and Geology Board[7] indicates that 19 surface mining operations are reported to exist in the jurisdiction of Mono County, as shown in Table 4.5-1. More recent information provided by Mono County indicates that 9 of these operations have closed since 2012, and all have been reclaimed and returned to open space or other approved uses.[8] Commodities produced include primarily sand and gravel, with subordinate amounts of cinder, clay, decomposed granite, fill dirt, sericite and pumice.

TABLE 4.5-1: Surface Mining Operations in Mono County as of September 2012 (Updated 2015)

Mine Name	Operator	Status	Approved Acres	Disturbed Acres
Black Point Cinder, Inc.	Sierra Aggregate Co.	Active	330	10
Hot Creek Kaolin Mine	Standard Industrial Minerals	Active (abandoned)	15	20
Pacific Sericite Mine	Standard Industrial Minerals	Active (idle)	5	5
Frank Sam Mine	U.S. Pumice Company	Active (idle)	219	0.90
#117 Pole Line Sites	Caltrans	Closed	40	0
#190 Baseline	Caltrans	Closed	37	0
#250 Rickey Ditch	Caltrans	Active	40	1.7
Desert Aggregates	Caltrans	Active	30	0
Cain Ranch	Marzano & Sons General Engineering Contractor	Active	14	30
Sonora Pit	Mono Co. Public Works Dept.	Active	3	4
Long Valley MMS	Mono County	Active	10	40
Facilities that have Closed Since 2012				
#24A North Benton	Caltrans	Closed	4	0
#116-12 Baseline	Caltrans	Closed	0	0
#135 Convict Creek	Caltrans	Closed	40	0.90
#189 Sweetwater	Caltrans	Closed	2.3	0
#205 Green Lakes	Caltrans	Closed	4.40	0
#210 Milner Fan	Caltrans	Closed	32	2
#213 Benton Hill	Caltrans	Closed	7	0
#273 Burcham Flats	Caltrans	Closed	2.7	0
Harris Flat	Kiewit Pacific Company	Closed	25	0

4.5.4 REGULATORY SETTING

4.5.4.1 Federal Regulations

The U. S. Department of Agriculture Natural Resources Conservation Service (NRCS): NRCS produces soil surveys that assist planners in determining which land uses are suitable for specific soil types and locations.

Earthquake Hazards Reduction Act: Congress passed The Earthquake Hazards Reduction Act in 1977 in order to reduce the risks to life and property associated with future earthquakes. The Act focuses on the establishment and maintenance of an effective earthquake hazards reduction program, the National Earthquake Hazards Reduction Program (NEHRP), which was subsequently amended by the 1990 National Earthquake Hazards Reduction Program Act (NEHRPA). Goals of the NEHRP are to enhance the understanding, characterization, and prediction of earthquake hazards and vulnerabilities; to improve building codes and land use practices; to reduce risk through post-earthquake investigations and education; improved design and construction techniques; improved mitigation capacity; and accelerated application of research results. FEMA (the Federal Emergency Management Agency) is the designated lead agency for

[7] State Mining and Geology Board, *Executive Officer's Report,* September 13, 2012 (Agenda Item #6).
[8] Source: Nick Criss, Mono County Compliance Officer, communication of 16 July 2015.

the NEHRPA, and other agencies participating in NEHRPA programs include the National Institute of Standards and Technology, the National Science Foundation, and the U.S. Geological Survey (USGS)

4.5.4.2 State Regulations

Alquist-Priolo Earthquake Fault Zoning Act of 1972: The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The Alquist-Priolo Earthquake Fault Zoning Act only pertains to geologic hazards associated with surface fault rupture. This law does not pertain to any other geologic hazards. The Mono County Multi-Jurisdictional Local Hazard Mitigation Plan notes that Alquist-Priolo Fault Hazard zones occur in a number of Mono County communities, particularly in communities located at the base of the Sierra Nevada and White Mountains. Ground failure induced by groundshaking includes liquefaction, lateral spreading, lurching, and differential settlement, all of which usually occur in soft, fine-grained, water-saturated sediments, typically found in valleys. During the 1980 Mammoth Lakes earthquake sequence, ground failure was prevalent at Little Antelope Valley, along margins of the Owens River in upper Long Valley, along the northwest margins of Lake Crowley, and along Hot Creek Meadow.

California Geological Survey (CGS): The California Geological Survey (CGS) provides regulatory information pertaining to soils, geology, mineral resources, and geologic hazards. CGS maintains and provides information about California's nonfuel mineral resources. California ranks second in the United States in nonfuel mineral production. In 2007, more than 30 nonfuel commodities were produced from 660 California mines (CGS 2008a). CGS also offers information about handling hazardous minerals and Surface Mining and Reclamation Act (SMARA) mineral land classifications. Information about CGS's role in the handling of hazardous minerals is provided in Chapter 4.16, "Hazards and Hazardous Materials." Information about SMARA mineral land classifications is provided directly below.

California Surface Mining and Reclamation Act (SMARA). SMARA) was enacted by the California Legislature in 1975 (PRC §2710 et seq.) to regulate activities related to mineral resource extraction. The act requires the prevention of adverse environmental effects caused by mining, the reclamation of mined lands for alternative land uses, and the elimination of hazards to public health and safety from the effects of mining activities. At the same time, SMARA encourages both the conservation and the production of extractive mineral resources, requiring the State Geologist to identify and attach levels of significance to the state's varied extractive resource deposits. Under SMARA, the mining industry in California must plan for the reclamation of mined sites for beneficial uses and provide financial assurances to guarantee that the approved reclamation will actually be implemented. The requirements of SMARA must be implemented by the local lead agency with permitting responsibility for the proposed mining project (see discussion below under 'Local Regulations'). Lands classified MRZ-2 are areas that contain identified mineral resources. If a use is proposed that might threaten the potential recovery of minerals from an area classified as MRZ-2, SMARA would require the jurisdiction prepare a statement specifying its reasons for permitting the proposed use, provide public notice of these reasons, and forward a copy of the statement to the State Geologist and the State Mining and Geology Board (PRC §2762). Notably, California is alone among the 'lower 48 states' in not regulating surface mine reclamation at the state level; permitting authority is decided by Lead Agencies at the local level. Mono County is one of 113 California lead agencies under SMARA (52 counties, 50 cities, and the State Mining & Geology Board). Under SMARA, there is no distinction between exploration and actual mining. Activities below the defined threshold (i.e., disturbance of more than 1 acre and/or displacement of more than 1000 cubic yards of material) are exempt from regulation, while those exceeding the threshold are regulated. Mining projects on federal land in Mono County would be required to meet NEPA provisions for environmental review with BLM or USFS serving as lead agency. BLM and USFS have mineral resource policies that reflect applicable federal laws and policies; these laws encourage the orderly and efficient development of mineral resources, consistent with applicable principles of environmental protection and multiple-use management. BLM and USFS policies must be consistent with state and local plans. Consistent with county code, Mono County issues 'mining operations permits' for lands over which it lacks full land use authority; the County issues 'use permits' for mining activities on lands for which it has full land use authority. The County also approves reclamation plans for mining projects in compliance with SMARA regulations and the county Reclamation Ordinance (County Land Development Regulations, Ch. 35).

Caltrans Seismic Design Criteria. The California Department. of Transportation (Caltrans) has Seismic Design Criteria (SDC), which identifies new and currently practiced seismic design and analysis methodologies for the design of new

bridges in California. The SDC adopts a performance-based approach specifying minimum levels of structural system performance, component performance analysis, and design practices for ordinary standard bridges. The SDC has been developed with input from the Caltrans Offices of Structure Design, Earthquake Engineering and Design Support, and Materials and Foundations. Memo 20-1 Seismic Design Methodology outlines the bridge category and classification, seismic performance criteria, seismic design philosophy and approach, seismic demands and capacities on structural components and seismic design practices that collectively make up Caltrans' seismic design.

California Geological Survey Strong Motion Instrumentation Program (CSMIP). Through the CSMIP, the California Geologic Survey installs earthquake-monitoring devices in structures such as buildings, hospitals, dams, utilities and industrial facilities. Data collected from those devices are used both for earthquake emergency response and for engineering and scientific research. Sites are selected according to long-term strategies developed in consultation with the Strong Motion Instrumentation Advisory Committee, a committee of the Seismic Safety Commission. SMIP stations in Mono County are maintained at the following locations:

- *Lake Crowley--Hwy 395 Bridge*
- *Lake Crowley--Long Valley Dam downstream*
- *Mammoth Lakes--Convict Creek*
- *Mammoth Lakes--High School grounds (temp.)*
- *Mammoth Lakes Fire Station # 1*
- *Chalfant--Zack Ranch*
- *June Lake Fire Station*
- *Benton*
- *Lee Vining--Tioga Pass*
- *Bridgeport*
- *Walker*

Division of Mines and Geology. The California Division of Mines & Geology (DMG) operates within the Department of Conservation. The DMG is responsible for assisting in the utilization of mineral deposits and the identification of geological hazards.

State Geological Survey. Similar to the DMG, the California Geological Survey is responsible for assisting in the identification and proper utilization of mineral deposits, as well as the identification of fault locations and other geological hazards.

California Building Standards Code (CBC). California provides minimum standards for building design through the CBC (CCR Title 24). The CBC applies to all occupancies throughout the state unless local amendments have been adopted, and includes regulations for seismic safety, excavation of foundations and retaining walls, and grading activities including drainage and erosion control and construction on unstable soils. The 2013 CBC, effective January 2014, updated all the subsequent codes under CCR Title 24. The 2013 CBC uses Seismic Design Categories A through F (where F requires the most earthquake-resistant design) to provide structural protection through "collapse prevention" at the maximum level of ground shaking that could occur. CBC Chapter 16 specifies how each seismic design category is to be determined for a site, based on soil characteristics and proximity to potential seismic hazards. Chapter 18 regulates the excavation of foundations and retaining walls, specifies conditions that require special studies (preparation of a preliminary soil report, engineering geologic report, geotechnical report, and supplemental ground-response report), and describes methods for analyzing expansive soils and determining depth to groundwater. table. For Seismic Design Category C, Chapter 18 requires analysis of slope instability, liquefaction, and surface rupture attributable to faulting or lateral spreading. For Categories D, E, and F, Chapter 18 requires these same analyses, plus evaluation of lateral pressures on basement and retaining walls, liquefaction and soil strength loss, and lateral movement or reduction in foundation soil-bearing capacity. It also addresses mitigations to be considered in structural design, such as ground stabilization, selecting appropriate foundation type and depths, selecting appropriate structural systems to accommodate anticipated displacements, or a combination of these measures. The potential for liquefaction and soil strength loss must be evaluated for site-specific peak ground acceleration magnitudes and source characteristics. Mono County complies with the adoption cycle for the California Building Code, and has adopted design standards specific to the local climate and topography.

Seismic Hazards Mapping Act. The Seismic Hazards Mapping Act passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically-induced landslides. Under the Act, seismic hazard zones are to be mapped by the State Geologist to assist local governments in land use planning. The program and actions mandated by the Seismic Hazards Mapping Act closely resemble those of the Alquist-Priolo Earthquake Fault Zoning

Act (which addresses only surface fault-rupture hazards) as outlined below. The State Geologist is required to delineate the various "seismic hazard zones." Cities and counties, or other local permitting authority, must regulate certain development "projects" in the zones and must withhold development permits until the geologic and soil conditions of the site are investigated and incorporate appropriate mitigation measures. The State Board of Mining and Geology provides additional regulations, policies, and criteria to guide cities and counties in their implementation of the law. The Board also provides guidelines for preparation of the Seismic Hazard Zone Maps and for evaluating and mitigating seismic hazards. Sellers (and their agents) of real property in a mapped hazard zone must disclose that the property lies within such a zone at the time of sale.

4.5.4.3 Local Regulations

Mono County General Plan Safety Element. To mitigate seismic hazard risks, the Mono County General Plan Safety Element (and the Town of Mammoth Lakes General Plan) regulates development near active faults, seismic hazard zones and other geologic hazards as required by the provisions of the Alquist-Priolo Special Studies Zone Act and the Seismic Hazard Mapping Act. Policies in the County Safety Element require projects in Alquist-Priolo fault hazard zones, seismic hazard zones, or other known geologic hazard areas, to provide a geologic or geotechnical report prior to project approval. County Safety Element policies also encourage applicants to design or redesign their projects as necessary to avoid unreasonable risks from seismic hazards and specify that the County will deny applications for planning permits where geologic studies provide substantial evidence that the proposed project will be exposed to unreasonable risks from seismic hazards. Projects that include mitigation measures to reduce risks to acceptable levels may be approved.

Land Clearing, Earthwork, and Drainage Facilities Regulations. This County ordinance, more commonly known as the Grading Ordinance (Chapter 13.08 of the Mono County Code) regulates grading, cut and fill, and drainage facilities for new development and improvements to existing development depending on the amount of planned site disturbance. The intent of the regulations is to ensure the safety and stability of development and to prevent on- and off-site erosion impacts. The ordinance requires a soils report prepared by a soils engineer for grading in, on, under, over or adjacent to old fills, swamp, marshlands, or in areas known or believed to be potential slide areas. Areas with expansive soils also require a soils report prepared by a soils engineer.

Land Development Regulations. Mono County Land Development Regulations restrict site disturbance in certain land use designations in order to protect environmentally sensitive areas and reduce landslide risk.

Unreinforced Masonry Mapping Program. In compliance with State law and Safety Element policies, the Mono County Building Department has identified potentially hazardous buildings and is developing a mitigation program for the identified buildings.

4.5.5 SIGNIFICANCE CRITERIA

Consistent with Appendix G of the CEQA Guidelines, the proposed RTP/General Plan update project will be considered to have a significant impact on soils, geologic and mineral resources if it will:

- **a) Expose people or structures to potential substantial adverse effects involving:**
  - **i) Rupture of a known Alquist-Priolo earthquake fault as delineated by the State Geologist or based on other substantial evidence?**
  - **ii) Strong seismic ground shaking?**
  - **iii) Seismic-related ground failure, including liquefaction?**
  - **iv) Landslides?**
- **b) Result in substantial soil erosion or the loss of topsoil?**
- **c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction or collapse, or be located on expansive soil creating substantial risks to life or property?**
- **d) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?**

e) **Result in the loss of availability of a known mineral resource or an identified locally important mineral resource that would be of value to the region and to residents of the state of California?**

4.5.6 ENVIRONMENTAL IMPACTS AND MITIGATING POLICIES

IMPACT 4.5(a): Would implementation of the proposed RTP/General Plan Update expose people or structures to potential substantial adverse effects involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map for the area or based on other substantial evidence of a known fault?

ii) Strong seismic ground shaking or landslides?

iii) Seismic-related ground failure?

POTENTIALLY SIGNIFICANT IMPACT. The *Multi-Hazard Plan* describes seismic hazards as a constant risk throughout the county including developed lands, and areas planned for future development. Earthquakes occur on an almost daily basis in Mono County. Alquist-Priolo Fault Hazard zones occur in communities throughout the county, particularly along the base of the Sierra Nevada mountains and the White Mountains. Strong earthquakes have occurred in the past in the Tri-Valley area, in the Long Valley area, and in Mammoth Lakes, and the entire county is subject to intense groundshaking resulting from seismic events. Figure 4.5-4 depicts the peak horizontal ground acceleration exceeded at a 10% probability in 50 years on a uniform firm-rock site condition (acceleration at 10% in 50 years ranges from about 0.1 g to over 1 g). As indicated, peak acceleration rates in Mono County range from 20% to 50% (by comparison, peak rates along portions of the San Andreas Fault exceed 80%).[9]

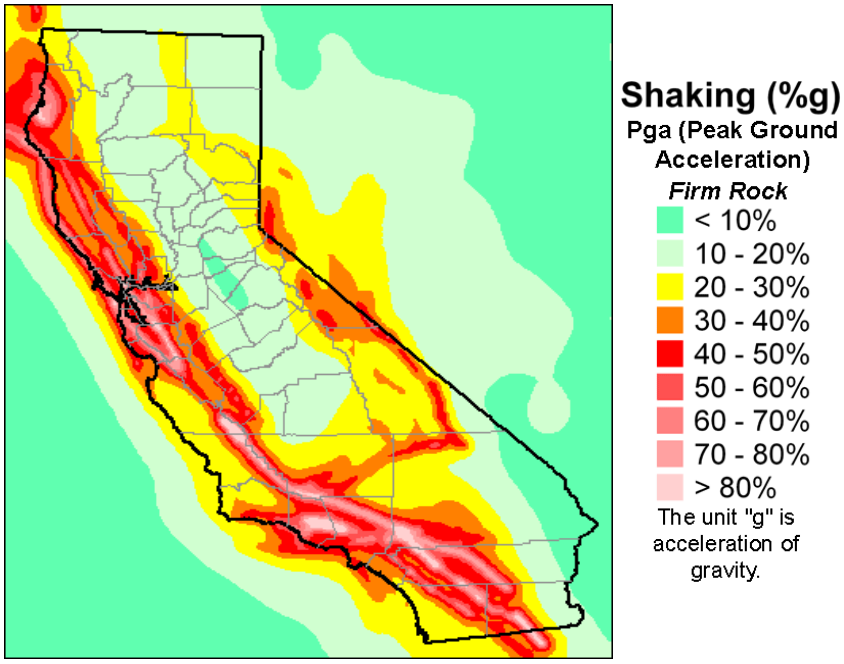

Figure 4.5-4: Seismic Shaking Accelerations in California

The California Geologic Survey has recently updated the state geologic map and earthquake fault activity map in recognition of its 150th Anniversary. The new versions are all-digital products, and relatively free of the distortions seen in the earlier versions. The 2010 Fault Activity Map presents a much more detailed depiction of faults in California than previous versions, and covers a time period dating from pre-quaternary (older than 1.6 million years) to historic faulting

[9]Seismic Shaking Hazards in California, Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003), 10% probability of being exceeded in 50 years. http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html

(the past 200 years). The mapping (available at http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html) shows Mono County with an especially rich network of faults dating to all mapped timeframes.

The *Emergency Operations Plan* (EOP) cites the USGS definition of "ground failure" as a term used to describe zones of ground cracking, fissuring, and localized horizontal and vertical permanent ground displacement that can form by a variety of mechanisms on gently sloping valley floors. Ground failure may be caused by surface rupture along faults, secondary movement on shallow faults, shaking-induced compaction of natural deposits in sedimentary basins and river valleys, and liquefaction of loose, sandy sediment. The effects resulting from ground failure include liquefaction, lateral spreading, lurching, and differential settlement, all of which usually occur in soft, fine-grained, water-saturated sediments that are typically found in valleys. The extent of damage depends on the magnitude of the earthquake, distance from the epicenter, and characteristics of surface geology. During the 1980 Mammoth Lakes earthquake sequence, ground failure was prevalent at Little Antelope Valley, along margins of the Owens River in upper Long Valley, along the northwest margins of Lake Crowley, and along Hot Creek Meadow.

As noted in the baseline, 55 developed parcels and more than 10 critical facilities are located in Alquist-Priolo Fault Hazard Zones; and nearly 1000 parcels and many more critical facilities are located in areas of strong seismic shaking. Additionally, future development associated with land uses shown in the 2015 *General Plan* would allow 43,000 more residents in Mono County at build-out than in the 2010 Census. Essentially all of these residents will experience seismic shaking during their tenure; many will experience strong seismic shaking, and some will be exposed to ground failure, liquefaction and earthquake-induced landslides. The EOP notes that a significant earthquake could exceed the response capabilities of Mono County; in such a case, response and disaster relief support would be required from other counties, private organizations, and from the state and federal governments. These limitations would be exacerbated by limited access to emergency services for some developed areas of the county, and most backcountry areas of the county (under normal conditions).

In compliance with state law, Mono County regulates development in and adjacent to identified fault hazard zones, and all new development must comply with current seismic safety standards. These standards reduce seismic hazards to a level of 'acceptable risk,' wherein the potential for significant human and property losses is outweighed by the benefits, given the probability of occurrence. Policies and actions in the *Draft RTP/General Plan Update,* as outlined in the section below, will support and strengthen these seismic safety programs and laws and regulations, but **will not reduce to less than significant levels** the threat of loss, injury and death involving seismic risk and exposure.

RTP/GENERAL PLAN POLICIES AND ACTIONS THAT MITIGATE POTENTIAL SEISMIC IMPACTS

Please refer to Table 4.5-5 in Appendix D.

IMPACT 4.5(b): Would implementation of the proposed RTP/General Plan Update result in substantial soil erosion or the loss of topsoil?

POTENTIALLY SIGNIFICANT IMPACT. The IRWMP notes that thin soils on steeper slopes tend to be highly erodible, as area areas where vegetation has been removed and soils mechanically compacted (e.g, roads, trails, construction sites, off-road vehicle routes), and exposed soils during high-wind events (see §4.6, Safety and Hazards, for further discussion of damaging winds in Mono County). As shown in Figure 4.5-5, large areas of the county have slopes of 16-30%, and the mountainous areas have slope gradients much higher than 30%. However, slopes of 0-15% are present through many areas of Mono County, including a majority of the privately owned land and developed community areas including the lands around Mono Lake, the Tri-Valley, Long Valley, and the corridor from Coleville north to the junction of US 395 with SR 89.

Erosion risks are also high in areas exposed to wildland fires, and the Mono County *Emergency Operations Plan* states that a majority of Mono County has a significant potential for wildland fires due to the presence of highly flammable fuel sources, long dry summers, and steep mountain slopes. Wildland fires as associated with significant environmental damage including loss of timber, wildlife habitat, scenic quality and recreational resources as well as soil erosion, sedimentation of fisheries and reservoirs, and downstream flooding. Erosion potential is increased by high-severity fires, which have become more numerous. The Sierra Nevada Conservancy references a USFS report *(Sierra Nevada Fire Severity Monitoring 1984-2004)* documenting the increase in the proportion of acres burned at high-severity: where 15% of burned at high-severity in 1984, the proportion had increased to 23% just 20 years later. The effect differed in relation to forest type. Although the proportion of severe fire in mixed conifer stand fires increased from 17% to 27%, the effect was most dramatic in white fir and black oak stands where high-severity fires increased by 200% to 300%.[10]

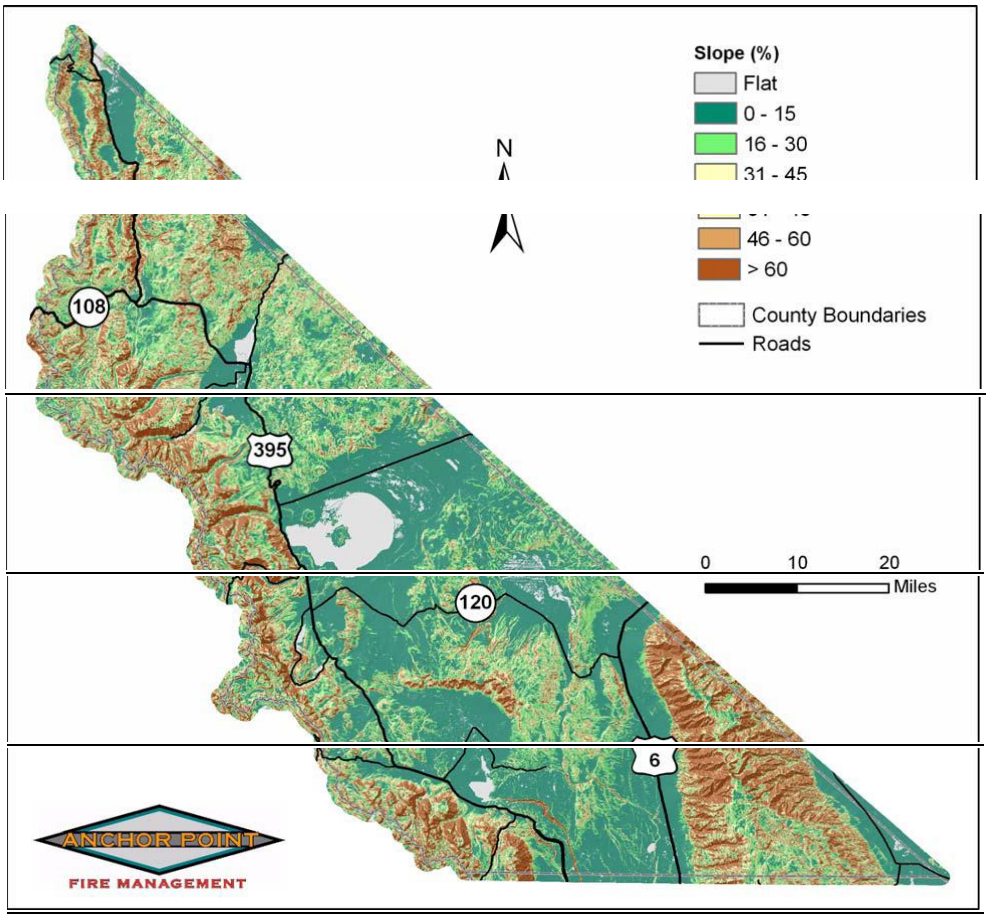

FIGURE 4.5-5: Mono County Slope Gradients[11]

A 2013 study by the USDA Forest Service indicates that homes located anywhere in the Wildland-Urban Interface (WUI) will eventually be exposed to wildfire, regardless of vegetation type or potential for large fires. There are many definitions of WUI; the Forest Service has described the WUI as any area where humans and human development meet or intermix with wildland fuel; a more precise definition cited in the study is lands with more than one housing unit per 40 acres where wildlands dominate the landscape (referred to as 'intermix'); higher density developments adjoining heavy natural vegetation is referred to as 'interface.' The study includes an estimate that about one-tenth of the land area occupied by housing, and about one-third of all housing units (homes, apartment houses, condominiums, etc.) in the conterminous United States are located in the WUI; from 1990 to 2000 alone, the total WUI area in the United States

[10] Sierra Nevada Conservancy, *System Indicators, Fire Threat,* September 2013.
[11] Mono County, *Community Wildfire Protection Plan,* prepared by Anchor Point Group. May 2009.

increased by 18%, with the addition of more than 6 million homes. Moreover, erosion control can be problematic in areas where fire hazard management calls for vegetation removal.

The California Regional Water Quality Control Board-Lahontan Region (LRWQCB) notes that the soils and waters of the Sierra Nevada have low buffering capacity for acids, and Sierra lakes and streams are sensitive to acidification from deposition of pollutants from urban areas. Water quality problems in the Lahontan Region are largely related to nonpoint sources, and erosion from construction is a major contributor to these problems.

In combination, the above factors indicate that approval and implementation of the *RTP/*General Plan Update will significantly increase the risk of soil erosion and loss of topsoil. The increased risk will result from development (particularly on steeper slopes) of homes and businesses, ancillary features and infrastructure (including roads, trails and construction sites), and from the increased risk of wildfire and associated erosion potential that are associated with approval and implementation of the Draft *RTP/General Plan Update*. Mono County Code §13.08.060 and 13.08.160 require the use of standard grading specifications in grading permits, and provide a streamlined permitting process to allow ministerial permit approval for complying projects. Additionally, policies are proposed in the *Draft Open Space and Conservation Element* to support use of Low Impact Development (LID) strategies that reduce impacts to watershed that are associated with development. These standards and policies will strengthen erosion controls countywide, but will not reduce such risk to less than significant levels. The project is found to have **potentially significant adverse impacts** in terms of soil erosion and loss of topsoil in future years.

RTP/GENERAL PLAN RECOMMENDATIONS, POLICIES & ACTIONS THAT MITIGATE POTENTIAL FOR SOIL EROSION

Please refer to Table 4.5-5 in Appendix D.

IMPACT 4.5(c): Would implementation of the proposed RTP/General Plan Update result in structures located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or off-site lateral spreading, subsidence, liquefaction or collapse?

POTENTIALLY SIGNIFICANT IMPACT. The *Multi Hazard Plan* notes that subsidence can be caused by tectonic movement of the earth, by withdrawal of fluids (such as groundwater or oil), by compaction (which occurs when copious amounts of water are applied to an arid area), or by severe loading, such as when large bodies of water are impounded. Subsidence is a global problem; the USGS estimates that more than 17,000 square miles in 45 States have been directly impacted by subsidence – due primarily to excessive groundwater withdrawal. The most dramatic tectonic subsidence occurs during earthquakes. During the May 1980 sequence of earthquakes near Mammoth Lakes, there were several locations near the Hilton Creek Fault where the ground surface dropped about four inches on the northeast side of fractures. Along the "Mammoth Airport fault zone", up to 12 inches of vertical offset on the east side of ruptures was observed (Taylor and Bryant, 1980). Another tectonic change in ground elevation that occurs in Mono County is associated with the movement of magma beneath Long Valley Caldera.

Liquefaction is defined by USGS as "*a phenomenon where saturated sands lose their strength during an earthquake and become fluid-like and mobile; as a result, the ground may undergo large and potentially damaging permanent displacements. The displacement of major concern associated with liquefaction is lateral spreading, wherein large blocks of ground move downslope or toward stream channels."* Mono County areas potentially subject to liquefaction include Sherwin Meadows, and areas in Old Mammoth.

Discussion under impact 4.5-1 noted that all of Mono County is subject to intense seismic groundshaking, and many communities are located in Alquist-Priolo Fault Hazard zones. Earth materials throughout the region for the most part are unconsolidated, particularly in the Long Valley caldera. Unconsolidated and locally moist soils contributed to ground failures from lurching, downslope movement, settlement, and liquefaction. Ground cracks were widespread in the

Mammoth Lakes region following the 1980 Mammoth Lakes earthquake sequence, and ground failure was prevalent at Little Antelope Valley, along margins of the Owens River in upper Long Valley, along the northwest margins of Lake Crowley, and along Hot Creek Meadow.

The *Draft 2014 Safety Element* indicates that subsidence in Mono County has been caused mainly by the tectonic movement of the earth and the movement of magma beneath the Long Valley Caldera. During the May 1980 sequence of earthquakes near Mammoth Lakes, the ground surface dropped about 4" at several locations near the Hilton Creek fault, and up to 12" of vertical offset occurred along the Mammoth-June Lakes Airport fault zone. Magma movement in the Long Valley Caldera has caused bulging of the resurgent dome by more than 30" since 1989 according to the USGS. The *Safety Element* indicates that no subsidence has been observed in the County due to fluid withdrawals. However, all major county groundwater basins have been identified by the Division of Mines and Geology as areas where subsidence could occur as a result of excessive groundwater pumping.

Expansive soils exhibit a shrink-swell behavior that results from the water-holding capacity of clay minerals; such soils are often poorly suited to onsite septic systems and can adversely affect the integrity of facilities such as pavement, foundations, and subsurface structures and utilities. Results of a USDA soil survey of Toiyabe National Forest[12] indicates that clay soils are widespread in that area, and recent studies for Inyo County indicate that clay soils may also be present in surficial and underlying deposits of the northern Owens Valley.[13]

Information provided in the *Safety Element*, the *Multi-Hazard Plan* and the *Emergency Operations Plan* (and elsewhere) indicates that many existing structures in Mono County are located on geologic units or soils that are or may become unstable, potentially resulting in lateral spreading, subsidence, liquefaction or collapse, or expansive soil conditions that may pose risks to life and property. Mono County has taken numerous steps to reduce erosion potential, and the proposed The *Draft RTP/General Plan Update* includes a wide range of additional policies and actions to ensure that future structures are located outside of high hazard zones. These measures will substantially reduce the potential for hazards from unstable substructures and soils. However, the breadth and geographic distribution of unstable geologic hazards within Mono County indicates that such **risks cannot be reduced to less than significant levels**.

RTP/GENERAL PLAN POLICIES AND ACTIONS THAT MITIGATE IMPACTS OF UNSTABLE SOILS

Please refer to Table 4.5-5 in Appendix D.

IMPACT 4.5(d): Would implementation of the proposed RTP/General Plan Update result in structures located on expansive soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water or creating substantial risks to life or property?

LESS THAN SIGNIFICANT IMPACT. Expansive soils exhibit a shrink-swell behavior that results from the water-holding capacity of clay minerals; such soils are often poorly suited to onsite septic systems and can adversely affect the integrity of facilities such as pavement, foundations, and subsurface structures and utilities. Results of a USDA soil survey of Toiyabe National Forest[14] indicates that clay soils are widespread in that area, and recent studies for Inyo County indicate that clay soils may also be present in surficial and underlying deposits of the northern Owens Valley.[15]

---

[12] USDA *Soil Survey of Toiyabe National Forest Area* obtained online at http://ucanr.edu/sites/mginyomono/files/181991.pdf
[13] Inyo County, Renewable Energy General Plan Amendment, Draft Program EIR (§4.6-Geology & Soils), November 2014.
[14] USDA *Soil Survey of Toiyabe National Forest Area* obtained online at http://ucanr.edu/sites/mginyomono/files/181991.pdf
[15] Inyo County, Renewable Energy General Plan Amendment, Draft Program EIR (§4.6-Geology & Soils), November 2014.

A study prepared by the UC Cooperative Extension notes that as of 1999, roughly 23% of all occupied homes in the US were served by septic systems; in Mono County, homes outside of Mammoth Lakes, Bridgeport, Lee Vining, June Lake and Crowley Lake are on septic systems. The most common cause of septic system failure is the nature of the soils used for the absorption field; as noted above, clayey soils are often poorly suited to septic systems. Other common causes of failure include improper design, and poor system use, management, and maintenance by the homeowner. In its comments on the Draft EIR for the 2000 Mono County General Plan Land Use Amendments, the LRWQCB noted that wetlands and some major surface water bodies in Mono County (including Bridgeport Reservoir, West Walker River, and others) have been significantly degraded due to cumulative effects increases in sediment and/or nutrient discharges from septic systems, erosion, fertilizers, and other sources.

The *Basin Plan* prevents water quality problems in large part through waste discharge restrictions that are implemented through Water Quality Certification, NPDES permits, waste discharge requirements and permits (WDRs, mainly used for point sources), discharge prohibitions, enforcement actions, special designations, and "Best Management Practices" (BMPs, mainly for non-point source discharges). Table 4.5-2 presents Waste Discharge Prohibitions in the *Basin Plan* for the Lahontan Region, including prohibitions for the region as a whole, and prohibitions for specific Mono County hydrologic units and areas.

TABLE 4.5-2: *Basin Plan* Waste Discharge Prohibitions In Mono County[16]	
REGIONWIDE PROHIBITIONS	
1. The discharge of waste(i) which causes violation of any narrative water quality objective contained in this Plan, including the Nondegradation Objective, is prohibited	
2. The discharge of waste that causes violation of any numeric water quality objective contained in this Plan is prohibited.	
3. Where any numeric or narrative water quality objective contained in this Plan is already being violated, the discharge of waste that causes further degradation or pollution is prohibited.	
4. The discharge of untreated sewage, garbage, or other solid wastes into surface waters of the Region is prohibited.	
5. For municipal and industrial discharges: (a) The discharge, bypass, or diversion of raw or partially treated sewage, sludge, grease, or oils to surface waters is prohibited. (b) The discharge of wastewater except to the designated disposal site is prohibited. (c) The discharge of industrial process wastes to surface waters designated for Municipal and Domestic Supply (MUN) beneficial use is prohibited.	
SPECIFIC MONO COUNTY HYDROLOGY UNIT/AREA PROHIBITIONS	
Walker River Hydrologic Units	1. The discharge of wastes from boats, marinas, or other shoreline appurtenances to surface waters of the East Walker River HU or West Walker River HU is prohibited.
	2. The discharge of any waste or deleterious material to surface waters of the East Walker River HU or West Walker HU is prohibited.[17]
	3. The discharge of any waste or deleterious material within the East Walker River HU or West Walker River HU, which would cause or threaten to cause violation of any water quality objective contained in this Plan, or otherwise adversely affect or threaten to adversely affect the beneficial uses of water set forth in this Plan, is prohibited.
Mono and Owens Hydrologic Units	1. The discharge of waste to surface water, including sewage or sewage effluent, is prohibited in the following locations: (a) Mill Creek and Lee Vining Creek watersheds, (b) Rush Creek watershed above the outlet from Grant Lake, (c) Owens River and its tributaries upstream of Crowley Lake above elevation 7,200', (d) Owens River and its tributaries downstream of Crowley Lake above elevation 5,000'. An exemption to this prohibition may be granted whenever the Regional Board finds (based on geologic and hydrologic evidence presented by the proposed discharger) that the discharge of waste to surface waters will not, individually or collectively, directly or indirectly, adversely affect water quality or beneficial uses.
	2. The discharge of waste from existing leaching or percolation systems is prohibited in the following areas: (a) Rush Creek watershed above the outlet of Grant Lake, (b) Mammoth Creek watershed above elevation 7,650', including the drainage area of the community of Mammoth Lakes. An exemption to this prohibition

[16] Water Quality Control Plan for the Lahontan Region (Basin Plan). Note that exhibits are provided in the *Basin Plan* for all regions, units and areas subject to the prohibitions listed in Table 4.5-2: http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml.

[17] This restriction has essentially shut down development in the Twin Lakes area near Bridgeport; the County Environmental Health Director notes that all allowed permits in the Twin Lakes have now been issued, and no further permits can be issued under current LRWQCB guidelines.

	may be granted whenever the Regional Board's Executive Officer finds (based on geologic and hydrologic evidence presented by the proposed discharger) that the continued operation of septic tanks, cesspools, or other means of waste disposal in a specific area will not, individually or collectively, directly or indirectly, adversely affect water quality or beneficial uses, and that the sewering of such area would have a damaging effect upon the environment.
	(3. Concerns Inyo County discharge prohibitions and thus deleted from this table)
	4. The discharge of waste from new leaching and percolation systems is prohibited in the following areas (For this prohibition, new systems are any installed after May 15, 1975): (a) Rush Creek watershed above the outlet from Grant Lake, (b) Mammoth Creek watershed upstream of the confluence of Sherwin and Mammoth Creeks, ('c' concerns Inyo County and thus deleted here), (d) Mammoth Creek watershed, including the drainage area of the community of Mammoth Lakes, and the Sherwin Creek watershed upstream of the confluence of Sherwin and Mammoth Creeks.
	5. The discharge of waste in the following described area from new or existing leaching or percolation systems is prohibited (For this prohibition, new systems are any installed after 15 May 1975): The area commonly known as the Hilton Creek/Crowley Lake communities (included in specified sections). An exemption to the prohibition against discharge of waste from new septic/leaching systems may be granted by the Regional Board's Executive Officer after presentation by the proposed discharger of geologic and hydrologic evidence and an acceptable engineering design that sufficiently demonstrate that use of the proposed leaching system will not, of itself or in conjunction with the use of other systems in the area, result in a pollution or nuisance, or other adverse effects to water quality or beneficial uses. An exemption to the prohibition against discharge of waste from existing septic/leaching systems may be granted by the Regional Board's Executive Officer after presentation by the discharger of geologic and hydrologic evidence that the continued use of an existing leaching disposal system will not, individually or collectively, result in a pollution or nuisance, or other adverse effects to water quality or beneficial uses.
WETLAND AND STREAM ENVIRONMENT ZONE	
Wetland and Stream Environment Zone Treatment Definition	Treatment areas inundated by water for a sufficient time to support vegetation adapted for life in saturated soil conditions. Some wetland/SEZ treatment structures incorporate small permanent pools while other systems distribute sheet flow across dense wetland/meadow vegetation. **Purpose:** Wetland/SEZ treatment systems effectively filter sediment and bioavailable nutrients from runoff waters. **Applicability**: Vegetative wetland storm water treatment is applicable in any area where there is sufficient space and hydrologic conditions that support thick hydrophytic vegetation. Any location in need of treatment with access to a densely vegetated area should consider this option. In addition to providing treatment, wetland systems help also control runoff volumes. Wetland construction or development of existing SEZ resources may require multiple local, state, and federal permits including, but not limited to, §401 water quality certification, §404 wetland permits, waterway disturbance permits, and Basin Plan prohibition exemptions. **Advantages:** Properly designed wetland and SEZ stormwater treatment systems have proven highly effective for removing bioavailable nutrients and fine sediment from urban runoff. Wetland treatment offers pollutant removal by infiltration, sedimentation, physical filtering, and biological uptake and conversion. Wetland and vegetated treatment systems can also be visually attractive and provide valuable habitat for migratory waterfowl. **Disadvantages:** Improper development or excessive pollutant loads can damage natural wetland systems. Clean Water Act §401 and §404 place strict regulations on potential impacts to wetland areas. Upsetting the natural nutrient and hydrologic balance of wetlands by introducing storm water may threaten their integrity, reduce water quality benefits, and impair beneficial uses. Some storm water professionals have raised concerns regarding potential impacts to wildlife attracted to storm water wetlands. Limited nutrient removal during the winter season when vegetation is dormant may be another possible disadvantage. Furthermore, decomposing wetland vegetation may release stored nutrients and other chemicals (such as heavy metals) to surface and groundwater. **Effectiveness:** Wetland treatment efficiency is a function of pollutant load, and thus can be highly variable. In general, nutrient removal efficiency drops with decreased nutrient concentrations. Another factor influencing nutrient removal is the seasonal nature of nutrient-laden runoff. Unlike areas on the East Coast of the United States where runoff occurs primarily during the growing season, much of the urban runoff in the Tahoe Basin occurs during the winter and early spring when vegetation is dormant.
Nondegradation Policy- Aquatic	All wetlands shall be free from substances attributable to wastewater or other discharges that produce adverse physiological responses in humans, animals, or plants; or which lead to the presence of undesirable

Communities and Populations	or nuisance aquatic life. All wetlands shall be free from activities that would substantially impair the biological community as it naturally occurs due to physical, chemical and hydrologic processes.
Application of Narrative and Numerical Water Quality Objectives to Wetlands	Although not developed specifically for wetlands, many surface water narrative objectives are generally applicable to most wetland types. However, the Regional Board recognizes, as with other types of surface waters such as saline or alkaline lakes, that natural water quality characteristics of some wetlands may not be within the range for which the narrative objectives were developed. The Regional Board will consider site specific adjustments to the objectives for wetlands (bacteria, pH, hardness, salinity, temperature, or other parameters) as necessary on a case-by-case basis. The numerical criteria to protect one or more beneficial uses of surface waters, where appropriate, may directly apply to wetlands. For example, wetlands that actually are, or that recharge, municipal water supplies should meet human health criteria. The USEPA numeric criteria for protection of freshwater aquatic life, as listed in Quality Criteria for Water—1986, although not developed specifically for wetlands, are generally applicable to most wetland types. As with other types of surface waters, such as saline or alkaline lakes, natural water quality characteristics of some wetlands may not be within the range for which the criteria were developed. Adjustments for pH, hardness, salinity, temperature, or other parameters may be necessary. The Regional Board will consider developing site-specific objectives for wetlands on a case-by-case basis.

The Basin Plan includes a special 'Nondegradation Objective' for surface waters, groundwater and wetlands of the Lahontan Region. The Objective was established under Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," which seeks to maintain the existing high quality waters of the state by requiring that where the existing water quality exceeds Basin Plan objectives, such existing quality shall be maintained unless appropriate findings are made under the policy. To preserve wetlands, the *Basin Plan* identifies major wetland resources and designates beneficial uses for each listed wetland including two beneficial uses that are specifically intended to recognize the unique water quality enhancing and flood attenuation properties of wetlands, The provisions include a 'nondegradation of aquatic communities and populations' water quality objective for wetlands, and an implementation plan for wetlands protection and management that includes a 'no net loss' policy, a commitment to ensure 'sequencing', and a commitment to explore means to reduce procedural complexity in wetlands permitting issues. The condition of major wetland resources are described in the RWQCB's Water Quality Assessment (see §3.4), and in the RWQCB's developing wetlands database. Wetlands issues and tasks specific to the focus watersheds can be found in Section 2 of this Chapter.

Clearly, Mono County surface waters and soils are highly sensitive to degradation from waste discharges. The prohibitions listed above broadly affect the regions from Topaz Lake down to Conway Summit as well as the regions from the Mill Creek watershed south to and including the June Lake Loop and down to the Inyo County line, and including the SR6 corridor from Benton south to the Inyo County Line. In effect, these prohibitions indicate that new leaching systems in many Mono County areas that are shown in the *Draft RTP/General Plan* update for future development (and existing leaching systems in some areas) will not be permitted unless present specific evidence is presented that such systems will not affect water quality or designated beneficial uses.

The stringent prohibitions already adopted by the State Water Resources Control Board, combined with the goals and policies contained in the *Draft RTP/General Plan Update*, *Basin Plan* requirements effectively preclude the possibility that project structures will be located on soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water or creating substantial risks to life or property. The prohibitions may also serve to limit the degree and extent to which land uses shown in the proposed *RTP/General Plan Update* can be implemented in the years to come. Based on the foregoing considerations, it is concluded that potential to locate structures on expansive soils incapable of adequately supporting use of septic tanks would be **less than significant.**

RTP/GENERAL PLAN POLICIES AND ACTIONS THAT MITIGATE IMPACTS OF WASTE DISCHARGES

Please refer to Table 4.5-5 in Appendix D.

IMPACT 4.5(e): Would implementation of the proposed RTP/General Plan Update result in in the loss of availability of a known mineral resource or an identified locally important mineral resource that would be of value to the region and to residents of the state of California?

POTENTIALLY SIGNIFICANT IMPACT. As noted in the baseline overview, significant mineral resources are present in Mono County. The MEA (Ch. XII-Geology) indicates that alluvial fans at the base of the mountains often contain abundant sand and gravel resources, and mining has a long and very colorful history in Mono County. As noted in the baseline overview, mining operations continue into the present era with 8 mines reported as active by SMGB. The Mono County MEA notes that numerous gold mining operations have been proposed in the Bodie Hills over the years, including a 2010 concept plan that would have necessitated removed the Wilderness Study designation from the Bodie Hills. The 2010 concept was not supported by the Mono County Board of Supervisors, and has since been withdrawn. However, the state has classified only a small portion of Mono County as having significant mineral resources. As part of the 2001 MEA, Mono County informally mapped mineral resources throughout the unincorporated lands, based on mining industry consultant recommendations (note that the maps have not been formally accepted by SMGB). Table 4.5-3 summarizes the 2001 MEA findings.

TABLE 4.5-3: MINERAL RESOURCE ZONES (MRZ) OF MONO COUNTY[18]

MONO COUNTY REGION	MINERAL RESOURCES
Antelope Valley	The majority of Antelope Valley is classified as MRA-1, MRA-3 or MRA-4. Areas classified as MRZ-2 include a large zone centered around the Lilly Mine to the northeast, and two small zones around Little Lost Canyon to the southwest.
Devil's Gate to Swauger Creek	MRZ-1 is the dominant classification in this region. One large region in the northern Sweetwater Mountains, with numerous mines (including the Montague and Angelo Mission mines) is classified as MRZ-2.
East Walker	More than half of this region is classified as MRZ-2, including large areas around Ferris Canyon on the east and a second large area around Masonic Mountain (again with numerous mines including the 'Success Mine'). A smaller area is shown in the far southeastern area around Rough Creek.
Bridgeport	Lands in this region are generally designated as MRZ-1, MRZ-3 and MRZ-4, with a large area shown as MRZ-2 extending from Bodie Mountain south to Rancheria Creek Spring, and two small pockets of MRZ-2 along Dog Creek.
Bodie	With the exception of 1 small outparcel, all lands around Rough Creek and Bodie Creek (on the north and northeast of this region) are designated as MRZ-2. The remaining lands are primarily designated as MRZ-1, with smaller areas of MRZ-3 and MRZ-3.
Mono Lake	Several areas around Mono Lake are designated as MRZ-2 including large zones north of the lake (just south of Bodie), a large pocket north of Lundy Canyon, an area located near Lee Vining Peak, and a large area extending south from the Mono Basin National Forest Scenic Area. Small areas of MRZ-3 and MRZ-4 are located around the lake, with a large area designated as MRZ-1 around most of the lake margin.
Cowtrack Mountain	Essentially the entire Cowtrack Mountain region is designated as MRZ-1; no lands are classified as MRZ-2.
Adobe Valley	While most of this region is designated as MRZ-3 and MRZ-4, a large area shown as MRZ-2 extends from just south of Antelope Mountain down toward Chalfant Valley, with a small pocket around Montgomery City and a larger area around Pedro Ranch Road. The

[18] Source: Mono County 2001 MEA, Figure 17A (Mineral Resources); note that the terminology used in 2001 ('mineral resource area', MRA) has since changed to 'mineral resource zone', (MRZ) as used herein.

	remaining lands are shared roughly equally by the MRZ-1, MRZ-3 and MRZ-4 designations.
June Lake	This region includes two large areas classified as MRZ-2, one of which surrounds Lookout Mountain, and a second that encompasses lands from the Buttes and the Craters down to just south of Bald Mountain Road. MRZ-1 is the dominant classification in the June Lake region, particularly on the east side, with numerous areas shown as MRZ-3 and MRZ-4 on the west side.
Long Valley	Much of the west-central portion of this planning area is designated as MRZ-2, north from the North Landing area of Crowley Lake on the east to the US 395 alignment on the west. This area is surrounded by MRZ-1, with numerous small pockets of MRZ-3 and MRZ-3 to the south and east.
Hammil Valley	Much of Hammil Valley is classified as MRZ-2, including most lands on the west, central and southern valley. The MRZ-1 classification covers a wide area of south central Hammil Valley, with smaller pockets of MRZ-3 and MRZ-4 on the northeast and east.
Wheeler/Paradise and Chalfant Valley	All of the Volcanic Tablelands area is designated as MRZ-2, as are the lands extending north and east of Chalfant.
Fish Lake Valley	None of the lands in this region are classified as MRZ-2. MRZ-4 is the dominant classification (covering essentially the eastern half), with large areas of MRZ-3 and smaller pockets of MRZ-1 on the west.
Sonora Pass & Walker Mtn.	All lands in these two regions are designated as MRZ-3.
Adobe Hills	All of the lands in the Adobe Hills region are designated as MRZ-1.
Mount Dubois	Lands along the Nevada border extending from just south of Indian Creek to north of Montgomery Creek are classified as MRZ-2; the remaining lands are designated as MRZ-3 and MRZ-4.
Tioga Pass and Ansel Adams Wilderness	MRZ-3 is the dominant classification in the Ansel Adams Wilderness, with a small pocket of MRZ-2 around Gem Lake; lands in the Tioga Pass area are shown as MRZ-3.
Glass Mountain and John Muir Wilderness	Most lands in the Glass Mountain area are designated as MRZ-1, with smaller areas shown as MRZ-3 and MRZ-4. The MRZ-3 and MRZ-4 designations dominate lands in the John Muir Wilderness with smaller areas shown as MRA-1. Neither region has lands designated as MRZ-2.
Mammoth Lakes	All lands in the town and extending north to Deer Mountain are classified as MRZ-1. Several small pockets of MRZ-2 are shown west of Deer Mountain, south of Mammoth Lakes and northeast of US 395. The remaining lands include small areas of MRZ-3 and MRZ-4.
White Mountain	The western portion of this area (west of Piute Mountain and north of Coldwater Canyon) is classified as MRZ-2; the remaining lands include the MRZ-1, MRZ-3 and MRZ-4 designations.
TERMS: *MRZ-1: Areas where adequate information indicates no significant mineral deposits are present or are likely to be present.* *MRZ-2: Areas where adequate information indicates that significant deposits are present or are likely to be present.* *MRZ-3: Areas containing mineral deposits the significance of which cannot be evaluated based on available data.* *MRZ-4: Areas where available information is inadequate for assignment to any other MRA.*	

In the discussion of issues and opportunities, the *Draft Conservation and Open Space Element* recognizes that Mono County has significant mineral resources within its boundaries, and acknowledges that SMARA requires local governments to plan for the conservation and development of significant mineral deposits. As noted in the Policy Table below, the *Draft Conservation and Open Space Element* contains a goal to provide for the conservation and development of mineral resources, supported by objectives that call on the County to local and identify significant mineral resources deposits, and to conserve and protect those areas in a manner that avoids or minimizes land use conflicts. The conservation objective includes a policy to assign the Division of Mines and Geology 'DMG' classification to lands with significant mineral resource deposits, with specific requirements for use applications submitted for areas with significant mineral deposits, and also requiring that the County *Land Use Element* designate such lands for uses consistent with conservation and potential development of the mineral resources.

However, many of the land uses envisioned in the *Draft RTP/General Plan Update* would have potential to occur on lands that are identified as having potentially significant mineral resources. Such uses could restrict the availability of state- or locally-designated mineral resources by creating uses that are incompatible with nearby resource extraction, and could foreclose the availability of such resources by constructing homes or other land uses on top of soils with significant mineral value. This possibility is presaged in the 'issues and opportunities' discussion that states, "*While the extraction of mineral resources is essential to the needs of society and contributes to the economy of Mono County, there is continuing concern over whether mineral resources should be developed, and, if development does occur, how to ensure that it will not cause significant adverse environmental impacts…mining activities on state or federal lands must comply with County environmental regulations."*

Given the level of development proposed in the *Draft RTP/General Plan,* the availability of minerals and aggregate resources will play a central role in determining future costs of roads, housing and other structures. USGS notes that demand for construction sand and gravel is determined mainly by construction activity, including the substantial share used for construction of roads and highways. Transportation cost is a major factor in the delivered price of construction sand and gravel (often exceeding the product value at the plant). As a result construction sand and gravel is generally marketed locally; USGS notes that economies of scale do not generally offset the increased transportation costs. Most sand and gravel is hauled by trucks; rail and water transportation together account for 10-20% of total construction sand and gravel shipments. Despite widespread availability of construction sand and gravel resources, local shortages do exist; such shortages are generally the result of land use conflicts, environmental concerns, demand pressures, land use regulations, and the costs associated with meeting environmental and reclamation requirements. USGS anticipates that future trends will favor larger operations with more efficient equipment, more automation, and better planning and design. Although no major shortages (at the national level) are expected to occur in the future, USGS expects that shortages in and near urban and industrialized areas will continue to increase.[19]

Presented in the section below are the *RTP/General Plan Update* policies and actions proposed for the development of mineral resources and the responsible management of resource extraction activities. These policies and actions will conform to SMARA directives to encourage the orderly and efficient development of mineral resources, consistent with applicable principles of environmental protection and multiple-use management. However, in light of the location and levels of development that would be allowed by the *Draft General Plan,* and recognizing that the *Draft Conservation/Open Space Element* raises substantive concerns about whether and how mineral resources should be developed, it is concluded that the potential impacts of *RTP/General Plan* implementation on mineral resources would be **potentially significant and adverse**.

RTP/GENERAL PLAN POLICIES AND ACTIONS TO MITIGATE POTENTIAL IMPACTS TO MINERAL RESOURCES

Please refer to Table 4.5-5 in Appendix D.

[19] USGS, *Construction Sand & Gravel Statistical Compendium*, Last Modified: Friday, 11-Jan-2013. Obtained at USFS website: http://minerals.usgs.gov/minerals/pubs/commodity/sand_&_gravel_construction/stat/.